REPLY TO DISCUSSION BY C. W. WASHBURNE ON "NOTES ON PRINCIPLES OF OIL ACCUMULATION"

A. W. McCOY
Bartlesville, Okla.

In reply to Mr. Washburne's discussion of this paper, each of his main points will be answered briefly in the following paragraphs.

The first criticism offered is that as to the origin of liquid petroleum from solid hydrocarbon waxes (commonly called kerogen) in the shale. The original paper states that "no appreciable amount of heat was developed," implying that the amount of heat developed was in no way comparable to the necessary distillation temperature for those hydrocarbons. The heat developed was not great enough to melt a thin coat of paraffin which had been placed around the bulging zone of the cylinders.

Moreover, the paper does not state that pressure was the direct cause for this change, but definitely says that pressure alone can cause no change in the material. It suggests that this change can take place in regions of differential movement, and that such zones are the only areas where liquid oil is likely to be made. Field observations indicate that such a condition exists, but a discussion of the point would necessarily be too long for this short statement. Pressure and release of pressure are essential for differential movement. The latter action is probably the real cause for any chemical change, whether resulting directly from developed heat or otherwise.

Mr. Washburne's suggestion that the chemical action of forming liquid petroleum from solid waxes is an exothermic one, and when once started will generate heat to carry on the action, neither agrees with the work of Engler and Hoefer, nor with the evidence gathered by the author from laboratory distillations. Before this

point could be considered seriously it would be necessary for Mr. Washburne to show the chemical equations of the action, the amount of heat absorbed or given out by each combination, and the resulting heat from the summation.

From the literature available, the author has been unable to secure enough detail on the geology of the Scottish oil shales to determine to what extent the shales have been altered, and how tests for liquid oil have been carried out in relation to such places. It is a well-known fact, however, that there are a few veins of gilsonite and other heavy hydrocarbons in joints or small fault planes of the Colorado-Utah oil shales, although they have not been altered by any widespread movement. These shales, as well as those of Scotland, are most probably non-marine in origin and differ somewhat from the marine type of bituminous shales which furnish petroleum.

The suggestion that the experiments should be carried out under pressures and temperatures prevalent for depths of several miles is good but unnecessary. At any given depth the temperature could be estimated, so that with temperature and the size of the openings known, it is merely a physical problem to determine the action. Pressure has such a small effect on surface tension that it may be neglected. Moreover, the majority of the oil sands in the Mid-Continent Field have never been buried more than five or six thousand feet and the actions at such depths are similar to those described in the experiments.

Mr. Washburne states that the asymmetrical distribution of oil in the Cushing and Yale fields indicates that lateral migration up the slope of sand beds is an important element in anticlinal accumulation. The author disagrees with this statement, as it is only a popular notion among oil geologists which has never had any substantial, scientific backing. On the other hand, the arrangement of the oil in these pools has a marked relation to the stress lines of the region and can be explained satisfactorily by this method as in the other pools of the mid-continent. Such an explanation would necessarily be long and does not directly refer to the subject of the original paper.

To say that the time has not yet come to abandon previous ideas concerning oil migration up the slope of a sand is only helping to cover a weak link in the anticlinal theory, and passing the responsibility of correcting questionable points before precedent has established a dangerous stone in the progress of the new science. Oil geology is now undergoing a crisis in its history, so the time is ripe for each follower in the science to face the facts squarely and to strive with an unbiased mind to reach the correct solution of oil accumulation phenomena. One of the world's greatest industries demands, by its expenditures of millions, that those offering scientific interpretation endeavor to gain the clearest and most logical principles based upon the maximum of details.

The discussion of this article has been most welcome.